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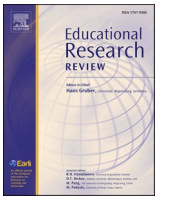

Review

A systematic review of the key components of online peer feedback practices in higher education

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ABSTRACT

There is a growing body of literature acknowledging peer feedback as a crucial learning practice in online settings. However, the literature is sparse and lacks an overall picture of the variety of key components for the successful implementation of peer feedback practices in online settings. To address this gap, we built our systematic literature review on the MISCA model, which is a well-known theoretical framework for evaluating feedback practices. This model outlines five components to evaluate feedback practices, including content, function, student characteristics, presentation, and source. Based on this model, we aim to present a comprehensive overview of the current state of research on online peer feedback practices in higher education, with a focus on the role of content, function, student characteristics, presentation, and source. A thorough search was conducted across three databases (Scopus, ERIC, and Web of Science), resulting in the analysis of 73 articles published between 2000 and 2022. The main results of this review indicate that cognitive feedback comments were the most frequently identified content in online peer feedback studies. Regarding function, most studies used peer feedback in function to improve students' task performance. Less than a quarter of the reviewed studies evaluated the role of individual student characteristics, while students' ability level and gender were the most explored factors. Rubrics and training were the most frequently implemented presentation modes of the online peer feedback studies. Only six studies combined feedback from peers with feedback from other sources. Overall, our findings make a valuable contribution to the literature by offering a comprehensive overview of the recent research on key components that impact online peer feedback practices in higher education. They also illuminate several potential interrelations that influence the implementation and effectiveness of online peer feedback practices. These findings can inspire instructors, practitioners, and scholars to gain a deeper understanding of the nature of peer feedback and how to make better use of it, thus fostering the effectiveness of their educational practices.

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1. Introduction

Online peer feedback has been found to be a promising and learner-centered instructional strategy in higher education for assisting students in gaining domain-specific knowledge (Cheng et al., 2015; Lee, 2015; Sabarinath & Quek, 2020; Valero Haro et al., 2019), enhancing their performance in writing high-quality essays (Abri et al., 2021; Latifi et al., 2021a; López-Pellisa et al., 2021; Noroozi & Hatami, 2018; Valero Haro et al., 2019), and improving feedback quality (Gielen & De Wever, 2015b; Latifi et al., 2020; Noroozi et al., 2016). Moreover, there is a growing body of literature that recognizes the importance of online peer feedback in improving students' self-regulation and metacognition (Latifi et al., 2021b; Simonsmeier et al., 2020), behavioral engagement (Al Qunayeer, 2020; Yuan & Kim, 2018), and learning motivation (Chen et al., 2020; Chew et al., 2016).

According to Breuch (2004), online settings refer to a technology-mediated communication mode. Building on this definition, in this review, we define peer feedback in online settings as technology-facilitated interactions among students where they submit their work online and engage in the exchange of feedback with their peers online as well (Jongsma et al., 2023; Latifi et al.,2021a). This form of feedback could be implemented through various online platforms and tools, such as blogs, discussion boards, collaborative writing software, as well as peer feedback software and tools (Dawson et al., 2018). Online peer feedback differs from offline peer feedback, where students engage in peer feedback practices in class, whether paper-based or face-to-face (Jongsma et al., 2023). Offline peer feedback, while widely practiced, has faced challenges such as limitations in time and place (Er et al., 2021), superficial feedback responses (Cho & Schunn, 2007), limited access to supplementary materials (Ezza, 2010), and shallow engagement (Chen, 2016). Recent studies suggest that online peer feedback can effectively address these shortcomings and challenges encountered in offline settings.

To be specific, online platforms, such as Peergrade, FeedbackFruits, and Eli Review, could provide students with greater flexibility to engage in the feedback process without any limitation on time and location (Du et al., 2022; Hoomanfard & Rahimi, 2020). Furthermore, the use of collaborative writing software, such as Google Docs, could not only enhance the quality of students' feedback, elevating it from surface-level to content-level, but also contribute to the improvement of students' writing skills (Andrichuk, 2016; Woo et al., 2013). In the online setting, students have time and flexibility to explore references and sources before providing feedback, ensuring more comprehensive and substantiated responses (Topping, 2023; Valero Haro et al., 2019). Another important advantage of online platforms lies in their ability to integrate diverse instructional supports (e.g., scripting and guidance) tailored for specific courses, tasks, or student needs. This guidance steers students toward effective interaction, ensuring that peers receive pertinent and high-quality feedback (Latifi et al., 2020). Moreover, online blogs and discussion boards offer additional opportunities for discussion and interaction between feedback providers and receivers. Such online settings can help students produce more effective and higher-quality feedback, elevating their motivation and overall satisfaction with the learning process (Dawson et al., 2018; Mostert & Snowball, 2013; Peeters, 2019; Shih, 2011; Xiao & Lucking, 2008).

The benefits of online peer feedback extend to teachers as well. The digital environment streamlines the process, alleviating the teacher workload and time constraints, especially in larger class sizes. Online platforms also facilitate more efficient tracking and evaluation of feedback, allowing teachers to better grasp the learning needs of individual students and the class as a whole. This heightened visibility into the feedback process empowers educators to adapt their teaching strategies accordingly (Ashenafi, 2017; Er et al., 2021; Wu et al., 2020). In the end, online peer feedback has the potential to be beneficial for both students and teachers in terms of efficiency as well as motivation, engagement, and quality.

While online peer feedback offers rich advantages, it also presents certain limitations for students and teachers. Without face-to-face interaction, online peer feedback makes it challenging to convey emotions and tone accurately, potentially causing misunderstanding and affecting the quality of interaction. In addition, asynchronous communication can result in delays in receiving feedback, explanations, and clarifications, impeding students' immediate engagement. Moreover, anonymity, intended to promote unbiased feedback, can also lead to non-specific feedback due to the lack of accountability. The anonymity-driven drawback may lead to less thoughtful and detailed feedback, thereby reducing the overall feedback quality (Topping, 2023). In light of these considerations, this study aims to disentangle the key factors that impact online peer feedback practices in higher education.

Researchers have investigated the variables that influence online peer feedback to help students overcome the hurdles in the peer feedback process and to increase peer feedback efficiency. Studies have shown that students with different levels of competence are affected differently by peer feedback on their presentation skills (Day et al., 2022). Cheng et al. (2015) suggested that different types of feedback content can have varying effects on students' writing performance. According to Gielen and De Wever (2015b), the content of peer feedback can be influenced by the structure of a peer feedback template provided to students. Numerous studies have evaluated how individual components of peer feedback, such as student characteristics, feedback content, and feedback delivery mode, can contribute to better peer feedback processes and the uptake of feedback. However, currently, few studies have evaluated the important components of peer feedback practices comprehensively, and only a few have provided a general overview of one specific component. For instance, Panadero and Alqassab (2019) carried out an in-depth analysis of the role of anonymity in peer feedback and peer grading in previous studies. Tillema et al. (2011) systematically identified the quality of feedback criteria in the peer assessment cycle. With a growing body of literature acknowledging peer feedback as a crucial learning practice in online settings, the literature is sparse and lacks an overall picture of the variety of key components for the successful implementation of online peer feedback practices in higher education.

To gain a comprehensive understanding of the role of all the important components in peer feedback practices and to provide recommendations for the subsequent implementation of peer feedback in practice, it is necessary to analyze the influence of different components in the peer feedback process. Thus, this review adopts a theory-oriented approach, with the objective of outlining key components of online peer feedback practices in higher education, enhancing the theoretical foundation of the field, and deepening the

understanding of the multifaceted nature of online peer feedback. The theory adopted in this review will be explained in the following section.

2. Conceptualizing the review

This review adopted the MISCA (Message, Implementation, Student Characteristics, Context, Agents) model proposed by Panadero and Lipnevich (2022). Based on fourteen selected feedback models, the MISCA model integrates five common components (Content, Function, Student Characteristics, Presentation, and Source) for classifying and describing different aspects of feedback practices. The model shows the complexity of feedback process and provides a theoretical framework for understanding and evaluating the key components that influence feedback practices. These five important components are used as a theoretical guideline to conduct the deductive content analysis and to elaborate on how each of these five components has been addressed in online peer feedback practices.

Content refers to the information learners receive about their performance. Several studies have placed a high value on feedback content because it connects the feedback provider with the receiver, and the students' task performance. Studies have presented various ways of categorizing feedback content. For example, Tsai and Liang (2009) classified peer feedback into affective, cognitive, and metacognitive dimensions. Narciss (2008) categorized feedback content according to outcome-related information into simple and elaborated types. With a deeper understanding of feedback content, researchers can grasp the viewpoints of feedback providers, which could help improve feedback content and quality, thereby enabling the feedback receivers to comprehend and use the feedback more effectively.

The *Function* of feedback covers the purpose of feedback practice, which focuses not only on improving task performance but also on enhancing students' competence. For example, Panadero and Lipnevich (2022) categorized feedback functions into three types: learning/performance, motivation/affect, and self-regulated learning. According to Wiliam (2016), the focus of the feedback should be on the students' development rather than the task. Teachers can make better use of feedback in class if they understand the function of feedback and arrange practice accordingly.

As the unique component that influences the other four, *Student Characteristics* are placed at the center of the MISCA model. Differences between both feedback providers and feedback receivers' characteristics affect their perceptions of peer feedback, the level of engagement, and content of peer feedback, thus influencing their feedback uptake and subsequent performance (Day et al., 2022; Kobayashi, 2020; Lee, 2015). Some studies measured several student characteristics, such as gender (Noroozi et al., 2022), family background (Lee, 2015), and students' learning level (Li & Gao, 2016). By understanding the role of student characteristics in peer feedback and their interaction with the other components, researchers and teachers can help design peer feedback activities that meet students' needs (Lipnevich et al., 2016).

Researchers are specifically concerned with how feedback is expressed and delivered. The *Presentation* of feedback refers to the pedagogical approach to feedback. Narciss and Huth (2004), for example, classified feedback presentation into four dimensions: immediate/delayed feedback, single/multiple tries, adaptive/nonadaptive, and unimodal/multimodal. How feedback is presented influences how students receive information and how much they can absorb and use it. As a result, numerous studies have been undertaken to assess the impact of various presentation strategies, such as anonymously/non-anonymously (Chen & Gao, 2022), feedback annotation (Lai et al., 2020), and multiple rounds of feedback (Chen et al., 2020). Furthermore, researchers have tried to use a range of instructional tools and assessment tools – such as guided questions and feedback templates – to improve the content and quality of students' peer feedback comments (Panadero et al., 2018). Latifi et al. (2020), for instance, measured the impact of worked examples and scripting on students' essay writing, the quality of argumentation feedback, and learning qualities.

As defined by Topping (1998), peer feedback is "an arrangement in which individuals consider the amount, level, value, worth, quality, or success of products or outcomes of learning of peers of similar status" (p. 250). The *Source* of feedback in peer feedback practice is from peers in the same situation. Nevertheless, some practices are not only limited to peers, but also include feedback from the teacher, themselves, and computers in online settings (Dippold, 2009; Prins et al., 2005; Yang & Meng, 2013). Feedback from diverse sources of varying quality and content influences students' performance differently (e.g., To & Panadero, 2019).

The MISCA model emphasizes an overall picture of five valuable components in feedback practices, which provides a solid foundation for this review to cluster and synthesize information from selected publications. This review aims to provide an overview of the role of five important components, including Content, Function, Students' characteristics, Presentation, and Source in online peer feedback processes in higher education. The novelty of this review lies in its adoption of a theory-oriented approach to provide a comprehensive outline of the key components within online peer feedback practices in higher education. The findings of the systematic review will provide a grounded analysis of the current state of knowledge on relevant components of peer feedback, extend the theoretical foundation of peer feedback, and shed light on the multifaced nature of its implementation and effectiveness in educational contexts. This review study aims to answer the following questions.

1. What content of online peer feedback in higher education has been identified?
2. What functions of online peer feedback in higher education have been found?
3. What student characteristics that influence online peer feedback in higher education have been determined?
4. What presentation modes of online peer feedback in higher education have been found?
5. What sources of online peer feedback in higher education have been identified?

3. Method

This systematic literature review followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines framework (Moher et al., 2009), following the process of developing a search strategy, defining inclusion and exclusion criteria, and identifying relevant publications. The whole screening process was independently carried out by two coders who were experienced in peer feedback research. First, the two coders randomly selected and evaluated 5 percent of the total articles, based on the criteria. Then, they discussed differences and reached a consensus. After that, the first coder screened and evaluated the remaining articles. Fig. 1 shows the process of selecting publications for this systematic review and the resulting number of publications.

3.1. Data bases and search strategy

A keyword search strategy was conducted based on the key concepts of the study, namely peer feedback, online education, and higher education. The search terms were selected based on recent relevant literature about peer feedback, improvement, higher education, and online. The keywords used for searching are shown in Table 1. A systematic search strategy was executed in April 2022 in the bibliographic databases Scopus, ERIC (Education Resource Information Center), and the Web of Science.

3.2. Criteria for inclusion and identification of relevant publications

In the first stage of literature screening, only peer-reviewed journal articles in English were included. In addition, because the quantity of peer feedback studies has grown since 2000, the search period of this systematic review was limited from 2000 until 2022.

To further identify publications relevant to the research questions, the second stage screened titles and abstracts. Articles that met the following criteria were included: articles that (1) focused on feedback between students; (2) were performed in online or blended educational environments; (3) included empirical experiments; (4) were conducted in higher education. This resulted in 109 papers. Of these, 30 papers were randomly selected and screened to examine the inter-rater reliability of the two coders, with the Kappa results (κ

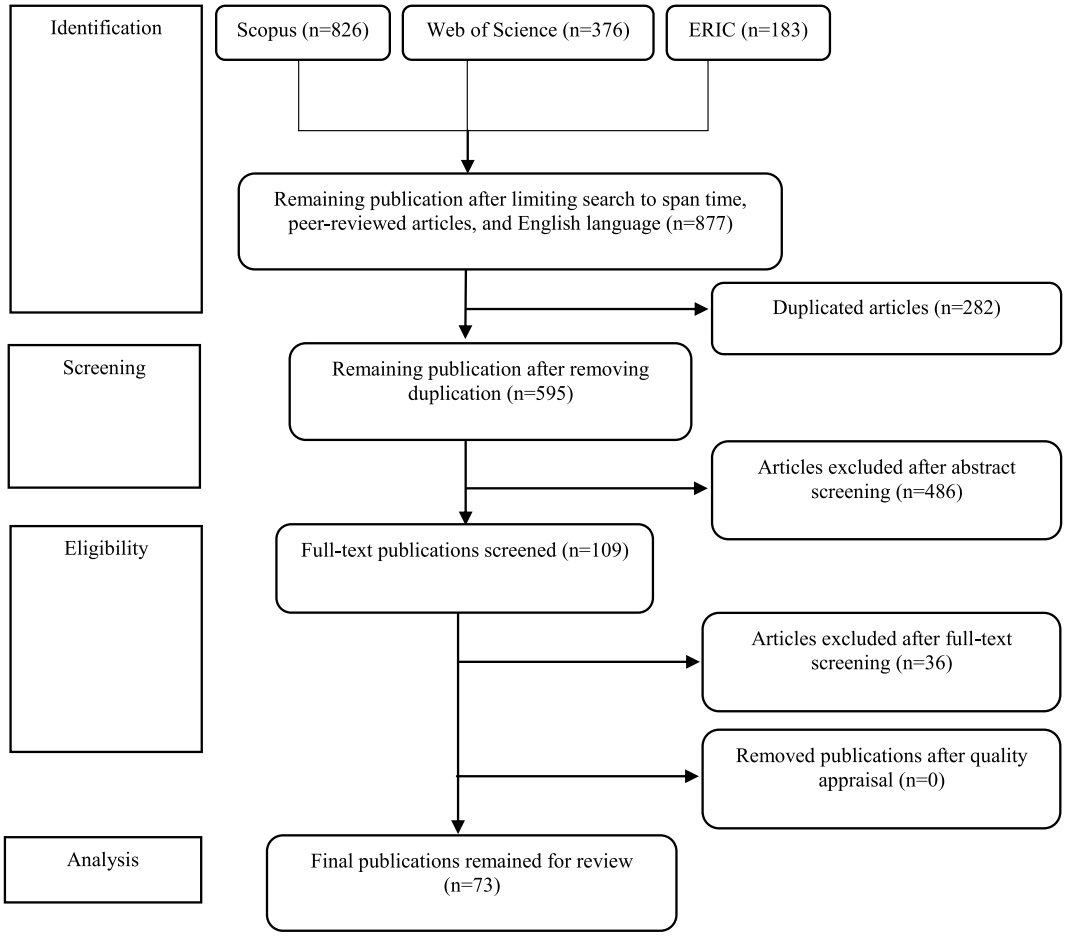

Fig. 1. Flowchart process selection.

Table 1
Searching key words.

Peer feedback "peer feedback" OR "peer review" OR "peer assessment" OR "peer learning"	AND	Improvement improv* OR develop* OR foster* OR promot* OR support* OR enhanc* OR teach* OR educat* OR learn* OR train*	AND	Higher education "higher education"OR "tertiary education" OR "post-secondary education"OR "postgraduate student"OR "university student"OR "graduate education"OR "graduate school"OR "college"	AND	Online online OR electronic OR Internet OR computer OR e-learning OR virtual* OR web-based

$= 0.86$, $p < .001$) indicating a high degree of consistency.

In the third stage, the full texts of the articles were screened, and several articles were removed. These included articles that: (1) did not focus on at least one of the five components in the MISCA model, including content, function, student characteristics, presentation, and source; (2) did not investigate written feedback comments; (3) did not have their full text available. The Kappa results ($\kappa = 0.68$, $p < .001$) between two coders screening eight papers showed a high level of agreement. This left 73 articles for quality appraisal.

3.3. Quality appraisal

The quality of the articles was evaluated following the criteria adopted by Theelen et al. (2019; Table 2), which were developed based on the evaluation of qualitative studies (Savin-Baden & Major, 2007) and quantitative studies (NICE, 2012). Among the included studies, there are qualitative studies ($n = 11$), quantitative studies ($n = 8$), and mixed method studies ($n = 54$). The quality of mixed-method studies was evaluated based on both qualitative and quantitative criteria. The quality of articles was measured from no mention (0) to extensive mention (3). Then, each article was given an average score based on its results in each category. Based on the criteria, the first and second authors randomly evaluated four articles from different methods. The four articles all received scores above 2 (Good Mention), although the reasons are slightly different. After achieving a consensus on the criteria through discussion, the first author evaluated the quality of the remaining articles. With all the average scores above 2 (Good Mention), no articles were excluded after the quality appraisal. In total, 73 articles remained for final analysis.

3.4. Included publications

Appendix A summarizes the characteristics of the reviewed publications by author and year, publication source, the number of participants, region, duration of research, discipline, learning platform, research methodology, and data collection method.

The reviewed articles were published between 2005 and 2022, with a significant increase since 2015. This indicates that peer feedback is a relatively new area of research in online higher education and is gradually gaining attention. The number of participants involved in the reviewed publications varied from 3 to 2421. Globally, more than half of the reviewed studies ($n = 39$) were conducted in Asian areas, particularly in Taiwan ($n = 21$; 28%), followed by the United States ($n = 12$; 16%), and the Netherlands ($n = 9$; 12%). The duration of the reviewed studies ranged from 4 h to two years, with 16 percent of reviewed studies conducted in the duration of 16 weeks (one semester; $n = 12$). Online peer feedback in higher education was utilized for a variety of subjects, and 30 percent of

Table 2
Criteria for the quality appraisal.

Criteria	No Mention (0)	Some Mention (1)	Good Mention (2)	Extensive Mention (3)
Criteria for qualitative studies				
Study is clear methodologically	2	13	43	7
Study theoretically situated	3	5	50	7
Ethical process transparent	2	4	46	13
Researcher(s') relation to participants is clear	4	9	46	6
Researcher(s') relation to the data is clear	0	5	51	9
Researcher(s') takes a critical stance towards own research	3	5	48	9
Congruence between methodology and methods used for data collection, analysis, and interpretation	0	10	39	16
Participants involvement in data interpretation	3	6	44	12
Limitations voiced	3	10	46	6
Criteria for quantitative studies				
Is the source population or source area well-described?	2	6	44	10
Were interventions and comparisons well-described and appropriate?	0	12	44	6
Were outcome measures reliable?	0	3	46	13
Were outcomes relevant?	0	10	29	23
Were the analytical methods appropriate?	2	4	39	17
Are the study results internally valid (i.e., unbiased)?	3	8	42	9
Are the findings generalizable to the source population (i.e., externally valid)?	1	6	49	6

Table 3
Content.

Category	Sub-category	Description	Example	Frequency (N)	Reference
Cognitive content	Problem-identification	Refers to feedback content that identify peer's weakness and errors, including global and local issues.	students did not pay much attention to the paragraph structure, grammatical format and other external features of the reports (Jiang et al., 2022).	18	Chang (2015); Chen et al. (2020); Chen and Gao (2022); Cheng and Hou (2015); Day et al. (2022); Dominguez et al. (2015); Gielen and De Wever (2015b); Illana-Mahiques (2021); Jiang et al. (2022); Noroozi et al. (2022); Noroozi et al. (2016); Noroozi et al. (2020); Saeed et al. (2018); Shih (2013); Tsai and Liang (2009); van den Bos and Tan (2019); van der Pol et al. (2008); Wang et al. (2020)
	Revision-oriented suggestion	Refers to feedback content that includes information to help students revise or improve their performance	reviewers produced a significantly higher percentage of revision-oriented suggestions or collaborative stance in post-modeling reviews (Chang, 2015).	11	Chang (2015); Cheng et al. (2014); Choi (2014); Day et al. (2022); Gielen and De Wever (2015b); Illana-Mahiques (2021); Jiang et al. (2022); Lai et al. (2020); Saeed et al. (2018); Shih (2011); van der Pol et al. (2008)
Affective content	Positive	Refers to feedback content that include encouraging, supporting emotions	students gave mostly commendatory or supportive comments and expressed more positive emotions towards the projects with high scores (Cheng et al., 2014).	5	Cheng et al. (2014); Cheng et al. (2015); Mandala et al. (2018); Tsai and Liang (2009); Zheng et al. (2018)
	Negative	Refers to feedback content that include opposing and discouraging emotions	for the lower performing groups, the students gave mixed reviews, provided suggestions and expressed more negative emotions (Cheng et al., 2014).	3	Cheng et al. (2014); Cheng et al. (2015); Zheng et al. (2018)
	Personal opinions	Refers to the feedback content that is personal but off-task	reviewers produced a significantly higher percentage of personal, non-evaluative reader comments and a lower percentage of evaluative and non-personal evaluator comments in the post- modeling reviews than pre-modeling reviews (Chang, 2015).	2	Chang (2015); Saeed et al. (2018)
	Emoticon	Refers to the emoticons that peers used to express their emotions	the most frequently used emoticons were categorized into two types: appreciative or encouraging emoticons and sad or questioning ones (Shih, 2011).	1	Shih (2011)
Metacognitive content	Evaluation	Refers to feedback content that include analyses on peers' knowledge and skills	Among all types of meta-cognitive comments, the most frequently seen across both experimental conditions was "evaluation" (Lin, 2018).	4	Cheng and Hou (2015); Cheng et al. (2015); Lin (2018); Zheng et al. (2018)
	Reflection	Refers to feedback content that include reflect on self-task or performance	during the last stage of the activity, continuity in the provision of specific suggestions for improving their work and in the reflection of peers' comments on their work to the groups with higher grades was observed (Cheng & Hou, 2015).	3	Cheng and Hou (2015); Lin (2018); Zheng et al. (2018)
	Regulation	Refers to feedback content that included analyses on students learning strategies	The experimental group had more comments related to "evaluation" and "regulation"(Lin, 2018).	1	Lin (2018)

reviewed studies used it in education science (n = 22). Various online learning platforms were utilized for online peer feedback practices in higher education. The most common of these were Facebook (n = 6; 8%) and Wiki (n = 6; 8%), followed by Blackboard (n = 5; 6%) and Moodle (n = 5; 6%). Additionally, only two reviewed studies focused on implementing mobile systems in order to support online peer feedback (Chang & Lin, 2020; Kuo et al., 2017). Reviewed articles included a variety of data collection methods; content analysis (n = 34; 47%) and questionnaires (n = 31; 42%) were the most regularly used data collection instruments.

Table 4
Function.

Category	Sub-category	Description	Example	Frequency (N)	Reference
To improve students' task performance	Improve students' writing performance	The study investigated the effect of peer feedback on students' writing performance	This study explores the relations between scripted online peer feedback processes and quality of written argumentative essay (Noroozi et al., 2016).	19	Abri et al. (2021); Chen and Gao (2022); Cheng et al. (2015); Choi (2014); Gielen and De Wever (2015b); Illana-Mahiques (2021); Latifi et al. 2021a; Liu et al. (2018); Mostert and Snowball (2013); Noroozi et al. (2022); Noroozi et al. (2016); Noroozi and Hatami (2019); Pham et al. (2020); Saeed et al. (2018); Shih (2011); Simonsmeier et al. (2020); Sun and Zhang (2022); Xiao and Lucking (2008); Zheng et al. (2018)
	Improve students' understanding of domain knowledge	The study investigated the effect of peer feedback on student's domain-specific learning	This study used an online peer assessment activity (with three rounds of peer review) to help a group of undergraduate students to learn biology through writing relevant science reports (Liang & Tsai, 2010).	8	Latifi et al. 2021a; Lee (2015); Liang and Tsai (2010); Naveh and Bykhovsky (2021); Noroozi and Hatami (2019); Sun et al. (2015); Tsivitanidou and Constantinou (2016); Zong et al. (2021)
	Improve students' skills in teaching-related abilities	The study investigated the effect of peer feedback on students' teaching-related abilities	to distinguish the effects of anonymity as incorporated into Facebook-based online peer assessment of micro-teaching performance (Lin, 2018).	6	Demir (2018); Demirbilek (2015); Li and Gao (2016); Lin (2018); Tsai and Liang (2009); Wang et al. (2020)
	Improve students' performance in text revision	The study investigated the effect of peer feedback on students' text revision performance	this study examined the degree to which online feedback training impacted EFL college students' text revisions (Yang & Meng, 2013).	3	van den Bos and Tan (2019); Yang and Meng (2013); Yang (2011)
	Other students' performance	The study investigated the effect of peer feedback on others task performance	The current paper investigated whether providing and receiving peer feedback using an online tool was related to improvement in students' presentation skills (Day et al., 2022).	12	Chang and Lin (2020); Chen et al. (2020); Cheng et al. (2014); Cheng and Tsai (2012); Day et al. (2022); Ge (2022); Ho (2020); Hsia et al. (2016); Kuo et al. (2017); Lin et al. (2021); Noroozi et al. (2020); Shih (2013)
To improve students' feedback performance	Improve feedback quality	The study investigates the effect of peer feedback on feedback quality	The present study aimed to examine the impacts of synchronous discussion between assessors and assesses on writing performance, qualitative feedback quality, meta-cognitive awareness and self-efficacy in web-based peer assessment (Zheng et al., 2018).	12	Chew et al. (2016); Ching (2014); Choi (2014); Gielen and De Wever (2015a); Hsia et al. (2016); Kobayashi (2020); Lin (2018); Mandala et al. (2018); Noroozi et al. (2022); Prins et al. (2005); van den Bos and Tan (2019); Zheng et al. (2018)
	Improve students' engagement in peer feedback	Peer feedback is implemented to promote students' engagement in peer feedback	To enhance student engagement in peer assessment, we designed and developed a web-based tool, autonomy-supportive peer assessment (Yuan & Kim, 2018).	3	Wilkinson (2022); Yu et al. (2019); Yuan and Kim (2018)
	Influence on students' attitude towards peer feedback	Peer feedback is implemented to influence students' attitudes towards peer feedback	the current study examines the effects that Facebook-based online peer assessment with micro-teaching videos can have on pre-service teachers' attitudes toward peer assessment and perceived learning from peer assessment over time (Lin, 2016).	2	Kaufman and Schunn (2011); Lin (2016)
	Other feedback aspects	Peer feedback is implemented to promote other aspects in feedback performance	The purpose of this study was to compare the effects of two peer assessment methods on university students' academic writing performance and their satisfaction with peer assessment (Xiao & Lucking, 2008).	7	Chang (2015); Cheng et al. (2014); De Brún et al. (2022); Hoffman (2019); Mandala et al. (2018); van der Pol et al. (2008); Xiao and Lucking (2008)
To improve students' learning behavior	Improve higher order thinking ability	The study investigates the effect of peer feedback on student's higher order thinking ability, such as critical thinking, problem-solving, and reflective thinking.	This study designs the strategy of peer assessment based on the theory of knowledge building to improve a class of 33 undergraduate students'	9	Cevik (2015); Demirbilek (2015); Dominguez et al. (2015); Ekahitanond (2013); Jiang et al. (2022); Li et al. (2008); Pham et al. (2020); Sun et al. (2015); Zhan (2021)

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Table 4 (*continued*)

Category	Sub-category	Description	Example	Frequency (N)	Reference
			critical thinking skills in one semester (Jiang et al., 2022).		
	Improve communication skills	The study conducted peer feedback to improve students' communication skills	One of the purpose of this study was to implement an online video peer assessment system to scaffold their communication skills (Lai, 2016).	4	Dominguez et al. (2015); Lai et al. (2020); Lai (2016); Prins et al. (2005)
	Improve deep learning	The study conducted peer feedback to improve students' in-depth learning process	This study is focused on how peer feedback in SPOCs (Small Private Online Courses) can effectively lead to deep learning (Filius et al., 2018).	3	Cheng and Hou (2015); Filius et al. (2018); Zheng et al. (2018)
	Improve students' participation	The study conducted peer feedback to improve students' participation in learning process	the proposed PAGA significantly increases student online participation (Lin et al., 2021).	2	Al Qunayeer (2020); Lin et al. (2021)
	Improve students' self-efficacy	The study conducted peer feedback to improve students' self-efficacy	an online peer-feedback system for dance education has been developed in order to compare the effects of different modes of online peer-feedback on students' dance skills performance, learning motivation, self-efficacy, peer review quality, peer assessment correctness, and online learning behaviors (Hsia et al., 2016).	2	Hsia et al. (2016); Zheng et al. (2018)
	Other behaviors	The study conducted peer feedback to improve other learning behaviors	this study aims to explore how students with various epistemic beliefs perform with regard to argumentative essay writing, domain-specific learning, and attitudinal change by exposing them to an argumentative peer feedback setting (Noroozi & Hatami, 2019).	3	Dippold (2009); Hsia et al. (2016); Noroozi and Hatami (2019)

Table 5
Students' characteristics*.

Category	Sub-category	Description	Example	Frequency (N)	Reference
Students' individual differences	Ability level	The study investigated the influence of student's different academic performance level on feedback and/or task performance	To evaluate the degree to which students at different English proficiency levels enhance their writing ability using the online feedback training, they were grouped into two groups—more- and less- proficient students (Yang & Meng, 2013).	9	Cheng and Hou (2015); Chew et al. (2016); Day et al. (2022); Illana-Mahiques (2021); Li and Gao (2016); Noroozi et al. (2016); Shih (2011); Yang and Meng (2013); Zhan (2021)
	Gender	The study investigated the influence of gender difference on students' performance	to explore the extent to which female and male students differ regarding their argumentative feedback quality, essay writing and content learning in an online environment (Noroozi et al., 2020).	3	Cheng et al., 2014; Noroozi et al., 2020, 2022
	Epistemic beliefs	The study investigated the influence of different epistemic beliefs on students' performance	there is a need for further empirical evidence on whether and how it is related to various aspects of argumentation- based learning namely argumentative essay writing, domain-specific learning, and attitudinal change while considering their epistemic beliefs which are known to be related to argumentation (Noroozi & Hatami, 2019).	2	Noroozi and Hatami (2019); Tsai and Liang (2009)
	Other student characteristics	The study investigated the influence of other students' personal differences on students' performance	to analyze the influence of entrepreneurial experience in the family and assessment mode on the performance of business planning (Lee, 2015).	4	Demirbilek (2015); Kobayashi (2020); Lee (2015); Shih (2013)

Note: "Students" refers to both feedback providers and receivers in the online peer feedback studies.

Table 6
Presentation.

Category	Sub-category	Description	Example	Frequency (N)	Reference
Assessment tools	Rubrics	The study provided rubrics to students for feedback comment and/or rating	students in the reviewer and peer groups had to review the plans and provide feedback based on the criteria of business planning (Lee, 2015).	33	Chen et al. (2020); Chen and Gao (2022); Cheng et al. (2015); Chew et al. (2016); De Brún et al. (2022); Demir (2018); Demirbilek (2015); Filius et al. (2018); Gielen and De Wever (2015a, 2015b); Ho (2020); Hoffman (2019); Hsia et al. (2016); Kuo et al. (2017); Lee (2015); Li and Gao (2016); Li et al. (2008); Lin (2016); Lin (2018); Lin et al. (2021); Liu et al. (2018); Mandala et al. (2018); Mostert and Snowball (2013); Naveh and Bykhovsky (2021); Noroozi et al. (2022); Prins et al. (2005); van der Pol et al. (2008); Wilkinson (2022); Xiao and Lucking (2008); Yuan and Kim (2018); Zhan (2021); Zheng et al. (2018); Zong et al. (2021)
	Feedback template	The study provided feedback template to show how feedback should be provided	the instructor provided the same structured PFB template to every student (Gielen & De Wever, 2015a).	11	Cevik (2015); Choi (2014); Filius et al. (2018); Ge (2022); Gielen and De Wever (2015a, 2015b); Lin (2016); Lin (2018); Sun and Zhang (2022); Wang et al. (2020); Wilkinson (2022)
	Task sample	The study provided task sample to show what is expected	Examples of the best previous works were shown and discussed (Dominguez et al., 2015).	8	Chen et al. (2020); Chen and Gao (2022); Demir (2018); Dominguez et al. (2015); Gielen and De Wever (2015b); Ho (2020); Noroozi and Hatami (2019); Prins et al. (2005)
	Feedback checklist	The study provided a checklist for students to guide their feedback process	a content condition, in which again the same PFB template was provided, but this time together with a content checklist form, which required the assessor to actually select the essential content from the paper, meaning that the content checklist was contextualized to a specific paper (Gielen & De Wever, 2015a).	5	Abri et al. (2021); Chang (2015); Choi (2014); Gielen and De Wever (2015a); Yang (2011)
	Guiding questions	The study provided guiding questions to promote feedback process	we included question prompts in order to scaffold students' reasoning and analysis, direct their attention to specific aspects of problem solving, and to facilitate online group discussions (Cevik, 2015).	5	Cevik (2015); Chew et al. (2016); Latifi et al. 2021b; Wilkinson (2022); Zhan (2021)
	Feedback guideline	The study provided feedback guideline to instruct feedback process	During weeks 6 and 7, the guidelines of giving feedback were introduced (Ekahitanond, 2013).	4	De Brún et al. (2022); Dominguez et al. (2015); Ekahitanond (2013); Filius et al. (2018)
	Annotation	Students annotated in task and provided comment on that part	Furthermore, students were required to write a short paragraph with general feedback comments and annotate at least one moment in the video with specific feedback for that moment (Day et al., 2022).	2	Day et al. (2022); Lai et al. (2020)
	Other tools	The study provided other assessment tool to promote feedback process	the assessee was provided with peer feedback request form, which required the assessee to formulate a specific feedback demand (Gielen & De Wever, 2015a).	4	Cevik (2015); Gielen and De Wever (2015a); Noroozi et al. (2016); Tsivitanidou and Constantinou (2016)
Instructional support	Training	The study provided training to support	the participants were engaged in a two-week training programme on	31	Abri et al. (2021); Chang and Lin (2020); Chang (2015); Chen and

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Table 6 (*continued*)

Category	Sub-category	Description	Example	Frequency (N)	Reference
		feedback process, such as technology training, feedback training	how to give feedback on wiki pages and how to create better quality comments, revisions, and suggestions on wiki pages (Abri et al., 2021).		Gao (2022); Choi (2014); Day et al. (2022); De Brún et al. (2022); Demirbilek (2015); Dippold (2009); Dominguez et al. (2015); Hoffman (2019); Illana-Mahiques (2021); Kaufman and Schunn (2011); Kobayashi (2020); Lai et al. (2020); Lai (2016); Li and Gao (2016); Liang and Tsai (2010); Lin (2016); Lin (2018); Lin et al. (2021); Mostert and Snowball (2013); Pham et al. (2020); Prins et al. (2005); Saeed et al. (2018); van den Bos and Tan (2019); Wilkinson (2022); Xiao and Lucking (2008); Yang and Meng (2013); Zhan (2021); Zheng et al. (2018)
	Discussion	The study conducted class discussion for students and teachers to exchange opinions	students practiced reviewing sample drafts in small groups, followed by a whole-class discussion (Chang, 2015).	23	Al Qunayeer (2020); Cevik (2015); Chang (2015); Choi (2014); De Brún et al. (2022); Demir (2018); Ekahitanond (2013); Filius et al. (2018); Ho (2020); Hoffman (2019); Kaufman and Schunn (2011); Kobayashi (2020); Li and Gao (2016); Li et al. (2008); Liu et al. (2018); Mostert and Snowball (2013); Prins et al. (2005); Shih (2011); Tsivitanidou and Constantinou (2016); van der Pol et al. (2008); Yang (2011); Yuan and Kim (2018); Zheng et al. (2018)
	Feedback practice	The study provided opportunities to practice peer feedback on sample task	giving them the opportunity to practise assessing a sample e-journal entry (Zhan, 2021).	5	Chang (2015); Wilkinson (2022); Xiao and Lucking (2008); Yang and Meng (2013); Zhan (2021)
	Others	The study conducted other supports to support peer feedback process	When providing feedback to peers, students were asked to use the role-play strategy (role play) by assuming a stakeholder's role of their own choice in the case scenario and providing constructive feedback from the perspective of the selected stakeholder (Ching, 2014).	2	Ching (2014); Dippold (2009)
Level of anonymity	Double-blinded	The identify of assessor and assessee are not disclosed	the whole review process was double blinded, with both the providers and receivers of feedback remaining anonymous throughout the process (Mandala et al., 2018).	35	Abri et al. (2021); Chang and Lin (2020); Chen et al. (2020); Cheng et al. (2014); Cheng et al. (2015); Cheng and Tsai (2012); Chew et al. (2016); De Brún et al. (2022); Dominguez et al. (2015); Ge (2022); Ho (2020); Hoffman (2019); Hsia et al. (2016); Illana-Mahiques (2021); Kaufman and Schunn (2011); Kuo et al. (2017); Lee (2015); Li and Gao (2016); Liang and Tsai (2010); Lin (2018); Lin et al. (2021); Liu et al. (2018); Mandala et al. (2018); Mostert and Snowball (2013); Naveh and Bykhovsky (2021); Saeed et al. (2018); Simonsmeier et al. (2020); Sun et al. (2015); Tsai and Liang (2009); Tsivitanidou and Constantinou (2016); van den Bos and Tan

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Table 6 (*continued*)

Category	Sub-category	Description	Example	Frequency (N)	Reference
					(2019); Wang et al. (2020); Yang (2011); Zhan (2021); Zong et al. (2021)
	Nonanonymous	The identify of assessor and assessee are discloused	an identifiable condition, in which assessors' full real names could be seen by their assesses (Lin, 2018).	6	Chew et al. (2016); Lai et al. (2020); Lin (2018); Liu et al. (2018); van den Bos and Tan (2019); Xiao and Lucking (2008)
	Partially anonymous	Not all rounds of feedback are anonymous	For the PA group, the first two peer reviews were anonymous, and the last two were identifiable (Kobayashi, 2020).	2	Cheng and Hou (2015); Kobayashi (2020)
	Single-blinded	The identify of feedback receiver was hidden and the feedback provider was identified	this study operationalized the online peer feedback as single-blind for the receiver (the identity of the receiver was hidden), whereas all the feedback providers posted feedback in real name (Chen & Gao, 2022).	1	Chen and Gao (2022)
Scoring	Peer comment with peer scoring	Student provided quantitative (score) and qualitative (comment) feedback	The assessment task included grade giving (quantitative assessment) and comment making (qualitative assessment) (Cheng & Tsai, 2012).	24	Chen et al. (2020); Cheng et al. (2015); Cheng and Tsai (2012); Day et al. (2022); Filius et al. (2018); Hsia et al. (2016); Jiang et al. (2022); Kaufman and Schunn (2011); Kuo et al. (2017); Lai et al. (2020); Lai (2016); Lee (2015); Li and Gao (2016); Li et al. (2008); Liang and Tsai (2010); Lin et al. (2021); Mostert and Snowball (2013); Naveh and Bykhovsky (2021); Sun et al. (2015); Tsai and Liang (2009); Wang et al. (2020); Xiao and Lucking (2008); Zheng et al. (2018); Zong et al. (2021)
	Peer scoring only	Student only rated peer's task	while students in the comparison group assessed their peers' articles by using a rating-only peer assessment method (Xiao & Lucking, 2008).	3	Chen et al. (2020); Hsia et al. (2016); Xiao and Lucking (2008)
	Peer comment with peer scoring and tutor scoring	In addition to peer comment and scoring, tutors also rated student's performance	The course teacher also scored each student's writing in each round by the same dimensions, which was viewed as the expert's scores (Liang & Tsai, 2010).	3	Kaufman and Schunn (2011); Lai et al. (2020); Liang and Tsai (2010)
	Peer comment with self-scoring	Student rated their own performance and provided feedback to peers	Each student enrolled in this class first submitted his/her report to the peer assessment system online and scored him/herself (i.e., self-assessment) (Liang & Tsai, 2010).	1	Liang and Tsai (2010)
Rounds of peer feedback*	Two rounds	Students involved in two rounds of peer feedback for one assignment	Two rounds of peer-assessment activities (Lai et al., 2020).	9	Chen et al. (2020); Kaufman and Schunn (2011); Lai et al. (2020); Lai (2016); Lin (2016); Mandala et al. (2018); Xiao and Lucking (2008); Yang and Meng (2013); Zheng et al. (2018)
	Three rounds	Students involved in three rounds of peer feedback for one assignment	The feedback messages given by 47 undergraduate students in a three-round online peer assessment review (Cheng et al., 2015).	7	Cheng et al. (2015); Gielen and De Wever (2015a); Jiang et al. (2022); Lee (2015); Liang and Tsai (2010); Sun and Zhang (2022); Tsai and Liang (2009)
	Multiple times	Students involved in multiple time of peer feedback for different assignments	Four video/article reflection topics were given throughout the semester, and each student completed eight peer assessments in total (Kobayashi, 2020).	2	Kobayashi (2020); Shih (2013)
Feedback evaluation	Feedback evaluation	Feedback receivers were asked to evaluate or	the participants were required to evaluate the usefulness of their peers' feedback at the end of	7	Abri et al. (2021); Dominguez et al. (2015); Filius et al. (2018); Gielen and De Wever (2015a);

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Table 6 (*continued*)

Category	Sub-category	Description	Example	Frequency (N)	Reference
		comment on the feedback content	online peer assessment (Zhan, 2021).		Kaufman and Schunn (2011); Yang (2011); Zhan (2021)
	Feedback rating	Feedback receivers were asked to rate the feedback content	they also provide their reviewers with feedback about the helpfulness of the reviews, again using a seven-point rating scale with written comments (Kaufman & Schunn, 2011).	3	Filius et al. (2018); Kaufman and Schunn (2011); Li et al. (2008)
	Feedback response	Feedback receivers were asked to response to the feedback content	the participants were encouraged to respond to the comments of their peers (Demir, 2018).	2	Demir (2018); Yuan and Kim (2018)
Group format	Individual	Student provided peer feedback individually	the students involved in this activity worked alone when assessing peers' projects (Cheng & Hou, 2015).	5	Chen et al. (2020); Cheng and Hou (2015); Demirbilek (2015); Mandala et al. (2018); Noroozi et al. (2020)
	Group	Students worked in group to provide peer feedback	the collaborative teams were instructed to meet together, and discuss and generate a single peer review (Mandala et al., 2018).	4	Al Qunayeer (2020); Chang and Lin (2020); Hsia et al. (2016); Mandala et al. (2018)
	Pair	Students worked in pairs to provide feedback to each other	Students were paired up in this group, giving scores and comments on each other's business plans according to the seven assessment criteria (Lee, 2015).	2	Cevik (2015); Lee (2015)
Feedback format	Written	Students provide written feedback	The student assessors had to input written feedback for their respective assessees on the onPear system within one week (Lin, 2018).	8	Chang (2015); Ge (2022); Kaufman and Schunn (2011); Lai (2016); Lin (2016); Lin (2018); Simonsmeier et al. (2020); Yu et al. (2019)
	Oral	Students provide oral feedback	They read each other's drafts and provided written feedback in English or/and oral feedback in Chinese (Yu et al., 2019).	1	Yu et al. (2019)
	Video	Students record a video to provide feedback	it was required that both video feedback and written feed- back should primarily be in Chinese (Ge, 2022).	1	Ge (2022)
Feedback timing mode	Asynchronous	Student provided feedback not at the same period	This asynchronous feedback giving assignment was completed through an "e-learning forum" on the university portal (Chen & Gao, 2022).	6	Al Qunayeer (2020); Chang (2015); Chen and Gao (2022); Filius et al. (2018); Latifi et al., 2021b; Saeed et al. (2018)
	Synchronous	Student provided feedback at the same period	allows students to provide anonymous and time-synchronized feedback (Ho, 2020).	3	Chang and Lin (2020); Ho (2020); Pham et al. (2020)
Feedback language	First language	Students used first language in peer feedback	it was required that both video feedback and written feed- back should primarily be in Chinese (Ge, 2022).	3	Cheng and Tsai (2012); Ge (2022); Yu et al. (2019)
	Second language	Students used second language in peer feedback	Class A was required to use English only (Sun & Zhang, 2022).	2	Sun and Zhang (2022); Yu et al. (2019)
	Optional first of second language	Students could choose to use their first or second language in peer feedback	Students were encouraged to give sentence-to-sentence feedback comments to the writing sample either in English or in Chinese (Chen & Gao, 2022).	1	Chen and Gao (2022)
	Translanguaging	Students used second language in peer feedback with the help of their first language	Class B translanguaging for online peer feedback (Sun & Zhang, 2022).	1	Sun and Zhang (2022)

Note: "Multiple rounds of feedback" refers to the frequency of peer feedback activities including both providing and receiving feedback.

3.5. Coding scheme and data analysis

The deductive and inductive content analysis method by Elo and Kyngäs (2008) was adopted in this review. The included publications were analyzed by employing deductive content analysis based on the five components, including Content, Function, Student Characteristics, Presentation, and Source. To address RQ1, RQ2, RQ3, RQ4, and RQ5, we analyzed the findings of Content, Function, Student Characteristics, Presentation, and Source separately, and adopted inductive content analysis to extract and categorize the various findings under a broader concept (see Table 3, Table 4, Table 5, Table 6, and Table 7). The authors engaged in multiple discussions to determine the coding scheme. Additionally, other authors verified the first author's coding for 5 percent of the publications. In cases of disagreement, the authors conducted calibration discussions to reach a shared understanding of the coding scheme and the coding results of the publications. The first author coded the remaining publications. Among those, publications for which the first author was uncertain were reviewed by other co-authors as well.

4. Results

The results of the coding and analysis of the reviewed publications are presented in Tables 3–7 according to their research questions. Each table shows how each component was addressed in the reviewed publications, including categories, sub-categories, explanations, relevant examples drawn from the reviewed publications, frequency of articles referring to each sub-category, and a full list of all the publications referenced. As one publication could refer to more than one sub-category, the frequency numbers of each sub-category may overlap.

4.1. RQ1: what content of online peer feedback in higher education has been identified?

As summarized in Table 3, the content of the feedback messages in reviewed publications was categorized into (a) *Cognitive content*, (b) *Affective content*, and (c) *Metacognitive content*.

Cognitive content was most frequently identified in reviewed publications ($n = 29$; 39%), while *Metacognitive content* was identified less often ($n = 8$; 10%). Generally, students tended to provide more problem-identification comments, especially global peer feedback, such as feedback on genre and structure, and less specific feedback, such as feedback on grammar, punctuation, and pronunciation (e.g., Chang, 2015; Chen & Gao, 2022; Gielen & De Wever, 2015b; Jiang et al., 2022). In addition, researchers have paid attention to *Affective content* ($n = 11$; 15%), which has a substantial impact on the process and outcome of online peer feedback. Students tended to provide positive and supportive feedback to their peers as opposed to negative comments (e.g., Cheng et al., 2015; Mandala et al., 2018). Moreover, emoticons were a way for students to express feelings of encouragement, sadness, and questioning in peer feedback comments, serving as a means to soften the tone and enhance politeness (Shih, 2011). By using emoticons, students could not only benefit from peer feedback but also strengthen their interpersonal relationships among group members. For example, students may use "@@" to show they are confused or speechless, and use ": D" to show they feel happy.

4.2. RQ2: what functions of online peer feedback in higher education have been found?

In the reviewed publications, the functions of peer feedback were categorized into (a) *to improve students' task performance*, (b) *to improve students' learning behavior*, and (c) *to improve students' feedback performance* (see Table 4).

More than half of the reviewed studies used online peer feedback *to improve students' task performance* in various disciplines ($n = 48$). Among these, the improvement of students' writing performance attracted the most attention, such as in English writing for EFL students (e.g., Abri et al., 2021; Chen & Gao, 2022; Pham et al., 2020; Shih, 2011), argumentative essay writing (Latifi et al., 2021b; Noroozi et al., 2016, 2020, 2022; Noroozi & Hatami, 2019), and writing in a particular style in a domain-specific area, for example, counter-offer writing performance (e.g., Liu et al., 2018). In addition, as mentioned earlier, peer feedback was used particularly frequently in educational science. Therefore, many studies explored the impact of peer feedback on knowledge and skills related to teaching (e.g., Demir, 2018; Demirbilek, 2015; Li & Gao, 2016; Tsai & Liang, 2009; Wang et al., 2020). Moreover, researchers have implemented peer feedback *to improve students' feedback performance* ($n = 24$; 32%), and most studies conducted peer feedback to enhance the quality of feedback comments (e.g., Kobayashi, 2020; van den Bos & Tan, 2019). Researchers have also measured the

Table 7
Source.

Category	Description	Example	Frequency (N)	Reference
Peer feedback with tutor feedback	Students received feedback from tutor	it was the tutor who was first to provide feedback in the first task, commenting on content as well as grammar (Dippold, 2009).	3	Dippold (2009); Lai (2016); Shih (2011)
Peer feedback with self-assessment	Students reviewed themselves	During PR, students reviewed both themselves and others through the rubric (Ho, 2020).	2	Ho (2020); Prins et al. (2005)
Peer feedback with feedback from system	Students received feedback from system	In addition, comprehensive explanations, which are the immediate feedback to students' detection and correction, are automatically provided by the CSCL system after students finish the task (Yang & Meng, 2013).	1	Yang and Meng (2013)

function of peer feedback *to improve students' learning behaviors* ($n = 23$; 31%). These include higher-order thinking skills gained the most attention, and most studies focused on the improvement of students' critical thinking skills (e.g., Demirbilek, 2015; Dominguez et al., 2015; Ekahitanond, 2013; Jiang et al., 2022; Zhan, 2021).

4.3. RQ3: what student characteristics have been determined that influence online peer feedback in higher education?

Twenty-four percent of the reviewed studies ($n = 18$) addressed the influence of student characteristics in online peer feedback practices. The reviewed publications investigated several student characteristics in online peer feedback experiments. These studies focused on *students' individual differences*, such as ability level, gender, epistemic beliefs, and a small collection of other student characteristics (e.g., entrepreneurial experience; see Table 5).

The most commonly studied factor was student ability level ($n = 9$; 12%) since it is widely shown that this influences student performance in peer feedback (e.g., Cheng et al., 2014; Cheng & Hou, 2015) and students' uptake of the comments they receive (e.g., Noroozi et al., 2022). The studies measured the ability level of students' academic performance (e.g., Chew et al., 2016; Demir, 2018; Li & Gao, 2016), writing ability (e.g., Illana-Mahiques, 2021; Noroozi et al., 2016; Yang & Meng, 2013), and English ability (e.g., Shih, 2011). Additionally, gender was also frequently addressed in peer feedback studies ($n = 3$; 4%).

4.4. RQ4: what presentation modes of online peer feedback in higher education have been found?

Table 6 shows the overview of the presentation component of online peer feedback in higher education, including (a) *assessment tools*, (b) *instructional* support, (c) *level of anonymity*, (d) *scoring*, (e) *rounds of peer feedback*, (f) *feedback evaluation,* (g) *group format,* (h) *feedback format*, (i) *feedback timing mode*, and (j) *feedback language.*

Nearly all reviewed studies ($n = 72$) provided students with *assessment tools* to show them the criteria for the task assessment and to help them navigate their peer feedback process. Almost half of the reviewed studies provided feedback rubrics to students ($n = 33$), including criteria for feedback comments and rubrics for peer rating (e.g., Hsia et al., 2016; Kuo et al., 2017; Lee, 2015; Zhan, 2021). Instructional support was often provided to students during online peer feedback ($n = 61$; 83%). Training was the most frequent form of instructional support ($n = 31$; 42%), and researchers provided students with various kinds of training, such as technology training on using online platforms (e.g., Chang & Lin, 2020; Chen & Gao, 2022; Illana-Mahiques, 2021), training on feedback criteria (e.g., Kobayashi, 2020; Lai et al., 2020), and training on the peer feedback process (e.g., Abri et al., 2021; De Brún et al., 2022; Illana-Mahiques, 2021); however, other studies decided not to provide peer feedback training for students (Dippold, 2009). Moreover, discussion was also commonly conducted in peer feedback practice ($n = 23$; 31%), which included the discussion of the sample task and template feedback (e.g., Choi, 2014), and rubric before the online peer feedback (e.g., Demir, 2018; Hoffman, 2019; Li et al., 2008), the discussion on the task (e.g., Ekahitanond, 2013) and the discussion of the feedback after the online peer feedback (e.g., Al Qunayeer, 2020; Filius et al., 2018). Among these, discussions occurred between students, i.e., assessees and assessors (e.g., Cevik, 2015; Chang, 2015), and between students and teachers (e.g., Ho, 2020; Liang & Tsai, 2010; Yang, 2011). In addition, the online discussion function provided by the online learning systems allows participants to have online interactions instead of in-person discussions (e.g., Al Qunayeer, 2020).

According to the reviewed publications, researchers have explored the influence of different *levels of anonymity*. Almost half of the reviewed studies used double-blinded ($n = 35$; e.g., Chew et al., 2016; Hoffman, 2019; Kuo et al., 2017; Liang & Tsai, 2010), and one study tried single-blinded, which showed that students responded positively to this form of anonymity (Chen & Gao, 2022). In addition to providing qualitative feedback from various sources, some studies have measured the impact of *scoring* on assignments. Peer comment with peer scoring was the most frequently used method ($n = 24$; 32%; e.g., Kuo et al., 2017; Mostert & Snowball, 2013; Wang et al., 2020). In addition, several studies reviewed conducted multiple *rounds of peer feedback* on one assignment. Most studies have been designed to have students provide two rounds of peer feedback ($n = 9$; 12%; e.g., Mandala et al., 2018; Xiao & Lucking, 2008; Yang & Meng, 2013). Some studies had students provide multiple times of peer feedback on different assignments (Kobayashi, 2020; Shih, 2013). To get a better understanding of feedback receivers' feelings and needs, some studies have implemented *feedback evaluation,* so requested feedback receivers evaluate, respond to, and rate the feedback comments they received from peers. The most common method was for receivers to evaluate or write comments on the peer feedback content ($n = 7$; 9%; e.g., Abri et al., 2021; Gielen & De Wever, 2015a; Zhan, 2021). Regarding *group format*, most of the studies asked students to provide feedback independently to various group members ($n = 5$; 6%; Chen et al., 2020; Cheng & Hou, 2015; Demirbilek, 2015; Mandala et al., 2018; Noroozi et al., 2020). However, some studies had students working in groups to generate feedback collaboratively (Al Qunayeer, 2020; Chang & Lin, 2020; Hsia et al., 2016; Mandala et al., 2018).

In terms of *feedback format*, the most frequently used was written comment ($n = 8$; 10%; e.g., Chang, 2015; Kaufman & Schunn, 2011; Simonsmeier et al., 2020), although some studies tried different ways, such as video feedback (Ge, 2022) and oral feedback (Yu et al., 2019). Regarding *feedback timing mode*, while most peer feedback research was now focused on an asynchronous method ($n = 6$; 8%; e.g., Al Qunayeer, 2020; Chang, 2015; Chen & Gao, 2022), some studies were beginning to explore synchronous peer feedback (Chang & Lin, 2020; Ho, 2020; Pham et al., 2020). When it comes to *feedback language*, some studies only required students to provide feedback in their first language (Cheng & Tsai, 2012; Ge, 2022; Yu et al., 2019), while other studies required students to use their second language (Sun & Zhang, 2022; Yu et al., 2019). Some studies also gave students the option of using either language (Chen & Gao, 2022) or examined the effect of translation on peer feedback (Sun & Zhang, 2022).

It should be noted that when analyzing *the level of anonymity, rounds of peer feedback, group format, feedback format, feedback timing mode*, and *feedback language*, we found that most articles did not describe these presentation modes, so only publications that mentioned relevant modes were analyzed.

4.5. RQ5: what sources of online peer feedback in higher education have been identified?

In peer feedback, the source of feedback is the student's peers. However, in some studies, the researchers introduced feedback from other sources in addition to peer feedback (see Table 7). In general, only 8 percent of the reviewed studies ($n = 6$) combined peer feedback with feedback from other sources. Tutor feedback was used most frequently ($n = 3$; 4%; Dippold, 2009; Lai, 2016; Shih, 2011), followed by student self-assessment (Ho, 2020; Prins et al., 2005), and feedback from the online system (Yang & Meng, 2013).

5. Discussion

This systematic literature review presents a comprehensive overview of the current research landscape in higher education concerning five essential components of online peer feedback: content, function, student characteristics, presentation, and source, as identified by the MISCA model. Our overarching results revealed a predominant emphasis on cognitive feedback comments within online peer feedback studies. The primary function of peer feedback, in most cases, was related to enhancing students' task performance. A small portion of the reviewed studies delved into individual student characteristics, with a main focus on students' ability levels and gender. Rubrics and training were found to be the most commonly employed presentation modes for online peer feedback. Finally, only a small subset of studies explored the integration of peer feedback with feedback from other sources.

In the following sections, we undertake a comprehensive exploration and interpretation of our findings concerning each component of online peer feedback. Subsequently, we adopt an analytical approach to explain the complex interplay among these five key components that constitute the foundation of online peer feedback practices in higher education. This in-depth analysis could unveil the potential interactions, offering valuable insights into how to seamlessly integrate and effectively implement peer feedback practices within the context of online higher education.

5.1. Content of online peer feedback

Our findings regarding the first research question raise the necessity for a more well-rounded approach to crafting feedback content. While we identified a prevailing cognitive focus within the content of online peer feedback, we also noted a significant underrepresentation of the equally vital aspects of high-quality feedback content, namely the affective and meta-cognitive content (as previously delineated by Nelson & Schunn, 2009; Patchan et al., 2016). This finding implies that while cognitive content has received due consideration, the holistic richness of feedback, encompassing emotional and reflective information, requires greater emphasis. The omission of affective and meta-cognitive content may potentially hinder the comprehensive development and growth of students in online peer feedback processes. Thus, it highlights an opportunity for educators and instructional designers to encourage a more comprehensive approach to peer feedback content, one that encompasses cognitive, affective, and meta-cognitive aspects to foster a more well-rounded and beneficial learning experience for students.

One possible explanation for the observed underemphasis on affective and metacognitive feedback content in online peer feedback practices may be attributed to the primary functions of peer feedback in most studies. These studies frequently center on enhancing students' task performance, such as improving writing skills or deepening their understanding of domain-specific knowledge (e.g., Abri et al., 2021; Chen & Gao, 2022). Consequently, researchers tend to prioritize cognitive feedback, as it directly addresses elements like identifying issues in peers' tasks (e.g., Kerman et al., 2022; Patchan et al., 2016).

Nevertheless, it is essential to recognize that while cognitive feedback, including problem identification and task revision-oriented suggestions, offers precise and constructive guidance for immediate performance enhancement, recent research emphasizes the influential role of affective and metacognitive peer feedback on students' overall engagement and subsequent task performance. For instance, students' reception and utilization of feedback can be significantly affected by both positive and negative emotional feedback (Cheng et al., 2014). Additionally, metacognitive feedback, which delves into the processes and self-regulation aspects of learning, has been shown to elicit deeper student engagement with the learning task (Alqassab, Strijbos, & Ufer, 2018; Hattie & Timperley, 2007).

Therefore, it becomes evident that a comprehensive approach to feedback content that encompasses cognitive, affective, and metacognitive aspects is not only conducive to immediate performance improvement but also holds the potential to enhance students' overall engagement and proficiency in subsequent tasks, fostering a more holistic and effective learning experience.

5.2. Functions of online peer feedback

The findings derived from our exploration of the second research question provide valuable insights into the multifaceted nature of online peer feedback in higher education. Predominantly, the primary function of online peer feedback revolves around enhancing students' task performance, with a specific focus on areas such as writing proficiency. This focus aligns harmoniously with the core definition of feedback, which is essentially geared towards bridging the gap between students' current levels of task performance and the desired benchmarks (e.g., Banihashem et al., 2022; Carless & Boud, 2018).

Our findings also illuminate other functions of online peer feedback. Notably, there is a concerted effort to improve students' learning behaviors, such as higher-order thinking skills (e.g., Jiang et al., 2022) and communication competencies (e.g., Lai et al., 2020). Furthermore, the quality of feedback they offer to their peers and their engagement in the feedback process itself emerge as crucial considerations. This holistic approach to feedback function emphasizes that online peer feedback serves as a catalyst not only for elevating academic task performance but also for nurturing positive transformations in students' broader learning behaviors and their ability to provide constructive feedback (e.g., Noroozi et al., 2022; Zhan, 2021).

One plausible explanation for these findings may be attributed to the evolving educational landscape over time. There is a growing acknowledgment that student development extends beyond mere task performance and should encompass the cultivation of skills such as providing effective feedback (Hattie & Timperley, 2007). In an era where critical thinking, effective communication, and collaborative abilities hold significant currency, educators and institutions are increasingly recognizing the vital importance of integrating these competencies into the fabric of the learning process.

In essence, the multifaceted function of online peer feedback emphasizes the overarching educational objectives of cultivating holistic growth among students. It extends beyond the confines of mere task performance improvement, striving to shape individuals who not only excel in their subject matter but are also proficient in the art of delivering constructive feedback and adept at self-directed learning. This comprehensive approach aligns with contemporary educational paradigms that prioritize the development of well-rounded individuals who can thrive in diverse academic and professional contexts.

5.3. Students' characteristics and online peer feedback

Our investigation into the third research question revealed a research gap in the existing literature concerning the role of individual student characteristics (including both feedback providers and receivers) in online peer feedback practices. This gap may be attributed to the inherent complexity associated with individual traits, which makes it challenging for researchers to evaluate it separately. Researchers may opt to prioritize variables that are thought to have a more direct influence on peer feedback outcomes, such as feedback presentation modes. Additionally, limited awareness among both researchers and practitioners concerning the potential significance of individual characteristics in the context of online peer feedback practices may contribute to the relatively scant attention given to exploring these features in research endeavors.

Although fewer than a quarter of the publications examined students' characteristics within the domain of online peer feedback practices, these studies notably prioritized the exploration of students' individual differences. Specifically, a central aspect of these individual differences revolved around students' ability levels, which emerged as a key influencer on student performance in peer feedback practices (e.g., Cheng et al., 2014; Cheng & Hou, 2015). These studies identified ability levels in relation to students' academic performance (e.g., Chew et al., 2016), writing proficiency (e.g., Illana-Mahiques, 2021), and English language proficiency (e.g., Shih, 2011).

Another significant student characteristic that exerted a discernible influence on online peer feedback practices was gender (e.g., Noroozi et al., 2022). This finding suggests that gender-related factors play a substantive role in shaping how students engage with and derive benefits from online peer feedback practices (e.g., Ranjbaran et al., 2023). In addition to ability levels and gender characteristics, students' epistemic beliefs emerged as a compelling factor in online peer feedback practices. This facet delves into how students perceive knowledge and construct their thought processes, ultimately influencing the manner in which they engage in providing online peer feedback (e.g., Banihashem et al., 2023; Noroozi & Hatami, 2019).

One possible reason for these findings could be related to the nuanced ways in which individuals from diverse backgrounds and with varying epistemic orientations engage with the feedback process (Noroozi, 2023). Gender-related factors, for instance, may influence communication styles, self-efficacy in giving and receiving feedback, or even the perception of authority within peer interactions (Fallan & Opstad, 2016). Similarly, students' epistemic beliefs can shape their receptiveness to feedback, their confidence in their own assessments, and their willingness to adapt based on peer input (Banihashem et al., 2023; Panadero et al., 2023; Ranjbaran et al., 2023). Acknowledging these intricate dynamics is crucial in designing effective online peer feedback interventions that account for the diverse characteristics and beliefs of students, ultimately fostering a more inclusive and beneficial learning environment.

In general, while limited empirical studies have centered on the influence of individual student characteristics in online peer feedback, theoretical studies (e.g., Panadero & Lipnevich, 2022) underscore the important role of these factors. The reviewed literature further affirms that individual student characteristics, encompassing abilities, gender, and epistemic beliefs, significantly contribute to the intricate dynamics inherent in online peer feedback practices. Recognizing these nuanced attributes stands to enhance the precision and efficacy of peer feedback strategies within the domain of online higher education.

5.4. Presentation modes of online peer feedback

Our exploration of the fourth research question, which examines how online peer feedback is presented in higher education, revealed that a considerable number of studies have taken into account various factors when implementing online peer feedback practices. Many studies incorporated various presentation modes into their online peer feedback practices. For instance, rubrics (Demirbilek, 2015), feedback checklists (Yang, 2011), or guiding questions (Cevik, 2015) were commonly used to facilitate the delivery of online peer feedback. Also, a considerable number of studies stress the importance of training in online peer feedback practices (Kobayashi, 2020). Furthermore, we see a wide variety of considerations on how to present online peer feedback: double-blind, non-anonymous, or partially anonymous (e.g., Abri et al., 2021), synchronously (Pham et al., 2020) or asynchronously (Saeed et al., 2018), individually (Chen et al., 2020) or in groups (Hsia et al., 2016), and in a written (Chang, 2015), oral (Yu et al., 2019), or video format (Ge, 2022).

These findings highlight the multifaced nature of presenting online peer feedback within higher education, revealing the diverse approaches that can be employed based on the specific educational objectives at hand. Indeed, research into the various presentation modes individually (Panadero & Jonsson, 2020) shows that the effectiveness of a particular presentation mode and its use depends on the aims and set-up of the course and study. In essence, how online peer feedback practices are presented can be tailored to align with the intended learning outcomes. For example, consider a scenario where the primary aim of online peer feedback is to facilitate students in developing the skills to identify issues in their peers' work and provide constructive feedback. In such cases, using guiding

questions and prompts as a way to present online peer feedback practices can be more effective (Latifi et al.,2021b; Zhan, 2021). By integrating guiding questions and prompts, online peer feedback can be transformed into a structured and instructive process, guiding students toward a deeper understanding of how to assess and improve their peers' work. This targeted approach aligns seamlessly with the educational objective of enhancing students' analytical and feedback-giving capabilities.

Regardless of the specific presentation mode employed, being explicit on the performance criteria is an undisputable key in effective feedback practices (Sadler, 1989). In line with this, many studies emphasize the importance of providing criteria and training students in peer feedback practices (Demirbilek, 2015; Kobayashi, 2020). Working with exemplars emerges as a promising method to enhance students' understanding of criteria, thereby fostering improved peer feedback practices (To et al., 2022).

5.5. Sources of online peer feedback

Our investigation into the fifth research question showed that the combinations of various feedback sources with peer feedback contribute to the diversity of online peer feedback practices. We found that there are other feedback sources combined with peer feedback, including the combination of peers as the source of feedback with tutors (tutor-feedback; Dippold, 2009), with students as self (self-assessment; Prins et al., 2005), and with feedback from the system (Yang & Meng, 2013). These findings imply that online peer feedback practices are not a unilateral process that only includes student-to-student interactions; rather, involve a dynamic interplay of various feedback sources.

This finding can be an indication of the complexity or potential richness of the peer feedback ecosystem where students engage in both collaborative and self-reflective processes, enhanced by technology, to enrich the learning experience and improve the quality of peer feedback provided and used.

5.6. The interconnection of five components of online peer feedback practices

As we explored the individual outcomes for each component of online peer feedback practices within higher education, it should be mentioned that these findings are, in essence, integral components of a broader peer feedback ecosystem. Within this ecosystem, dynamic interaction and interconnection among these components are necessary for the successful implementation of online peer feedback practices in higher education. The importance of such interconnections of the components is highlighted by the MISCA model developers (Panadero & Lipnevich, 2022) as well, as they indicated that the efficacy of online peer feedback practices requires a well-grounded interaction of all five key components of peer feedback.

Even though our research questions focused on the five key components independently, our results show various connections and dynamic interactions between the components. These interconnections are necessary for enhancing the efficiency or effectiveness of online peer feedback. While our discussion here is not exhaustive, we would like to emphasize some noteworthy interconnections that were identified in our study.

Our findings on the content – focusing mostly on cognitive aspects – and the function of peer feedback – focusing mostly on improving task performance – are likely to enhance one another. If the function of peer feedback is also to enhance students' feedback literacy or learning strategies, the content of the feedback is likely to be more geared towards metacognitive aspects or affective aspects of dealing with feedback (Carless & Boud, 2018). Furthermore, the content of peer feedback is related to students' characteristics, such as their epistemic beliefs and gender (e.g., Noroozi et al., 2022; Noroozi & Hatami, 2019). For instance, it has been noted that female students tend to provide more cognitive feedback compared to their male counterparts (Noroozi et al., 2022). Additionally, the mode of presentation can significantly impact the content of peer feedback. As rubrics were found to be the most used way of presenting peer feedback, the design of the rubric and the criteria used in rubrics can strongly guide how students use the rubric for feedback (Panadero et al., 2023) and thereby impact the content and even the function of the (online) peer feedback. Anonymity in online peer feedback tends to foster a more straightforward environment where students can feel comfortable delivering critical feedback. Several studies have shown that students in anonymous conditions tended to provide more cognitive comments, such as critical feedback and constructive suggestions for further improvement (Howard et al., 2010; Lin, 2018; Sha et al., 2022). It is worth noting that the impact of anonymity on feedback may be influenced by cultural factors. For example, in Sha et al. (2022) conducted in China, anonymity created an environment in which students felt more at ease and safe to provide in-depth suggestions and criticize their peers. This allowed them to express their opinions without concerns about harming interpersonal relationships or facing criticism or ridicule for providing constructive input. Conversely, non-anonymous settings often lead to more positively oriented, yet perhaps more meta-cognitive, feedback exchanges among peers (Lin, 2018).

Furthermore, the quality of peer feedback content can be further enriched when combined with feedback from other sources, such as tutors and automated systems employing AI and learning analytics (Banihashem et al., 2022; Farrokhnia et al., 2023; Van den Boom et al., 2007). For instance, research by Van den Boom et al. (2007) suggests that combining reflective practices with input from both tutors and peers results in higher learning outcomes. More recent studies on internal feedback (Nicol, 2021) suggest that combining internal feedback processes with peer feedback fosters more effective and more efficient learning processes.

Understanding these relationships provides a foundation for refining peer feedback strategies within higher education settings. Furthermore, it highlights the crucial note that successful implementation of online peer feedback practices in higher education requires a thoughtful understanding of how five key components of online peer feedback practices interact with each other and how they should be linked together to ensure the online peer feedback practices optimization.

6. Limitations and implications for future research

This systematic literature review has several limitations that need to be acknowledged. First, it only included empirical studies, potentially excluding some influential reviews and conceptual papers. To enrich future research in this area, we recommend adopting a more inclusive approach, encompassing review studies. This broader perspective can offer a more comprehensive and holistic understanding of online peer feedback practices in higher education. Second, this review is confined to the context of higher education in online settings, so it does not explore the practice of peer feedback in primary, secondary, or other educational settings. As the presentation modes of peer feedback might vary across different educational settings (Alqassab et al., 2023), it is important to note that the findings of the present study may not be applicable to all educational environments. Nevertheless, the results of our study, coupled with the mapping into the MISCA model, could serve as concrete starting points for studying comprehensive peer feedback practices in diverse educational contexts. Future research could investigate how the different components of the MISCA model perform across different educational settings, offering insights into the similarities and differences in online peer feedback practices influenced by varying educational contexts. Third, the review analysis was limited by the lack of clear descriptions of the peer feedback process and presentation modes, such as the type of feedback format or feedback language. This limitation was also noted by other review studies (e.g., Alqassab et al., 2023; Ashenafi, 2017). As a result, future experimental studies could provide a detailed description of the peer feedback process and its presentation modes in online higher education settings.

Fourth, our study did not delve into the potential variations in peer feedback practices arising from different online platforms. We encourage future studies to investigate the impact of various online platforms on the implementation and effectiveness of online peer feedback practices in higher education. Such research could potentially provide insights into how technology and platform choices can shape the peer feedback experience for both students and educators (see Kerman et al., 2023). Certainly, with the upcoming Artificial intelligence, this will be a critical road for further inquiry. Finally, although it was stated that there should be a dynamic interaction between the five components of online peer feedback practices for effective outcomes (Panadero & Lipnevich, 2022), most reviewed publications tend to focus on the impact of only one or two components of online peer feedback practices (e.g., Ching, 2014; Demirbilek, 2015). It could be related to the fact that most feedback models only focus on one or two components (Panadero & Lipnevich, 2022). For example, one of the most cited feedback models by Hattie and Timperley (2007) emphasized two main components: (a) what are the intended learning goals (i.e., Function), and (b) four types of content (task, process, self-regulation, and self) that effective feedback includes (i.e., Content). Future studies can focus on considering the synergies and interrelationships among these components and exploring how all key components of online peer feedback practices interact and contribute to the successful implementation of online peer feedback practices in higher education.

7. Conclusion

This systematic literature review utilized a theory-oriented approach, employing the MISCA model (Panadero & Lipnevich, 2022), to explore the literature on online peer feedback practices in higher education. The primary objective was to map empirical research on five key components that influence online peer feedback practices (online peer feedback content, function of online peer feedback, students' characteristics influencing online peer feedback practice, type of presentation of online peer feedback, and source of feedback that is combined with online peer feedback) for the purpose of providing a comprehensive overview of the current state of research on these key components in online peer feedback practices.

This study offers a coherent and deep insight into the landscape of online peer feedback practices in higher education. By adopting the MISCA model, this study extends our understanding of how the theoretical foundation of peer feedback is related to online peer feedback practices, fosters further theoretical development in this field, and provides a structured framework for understanding and analyzing components that influence online peer feedback practices in higher education settings. In addition, our findings contribute to a deeper understanding of the multifaceted nature of online peer feedback practices. It sheds light on the components and their potential interrelations that shape its implementation and effectiveness in higher education contexts.

From a practical point of view, understanding the important components of online peer feedback practices is important for instructors to find out the nature of peer feedback and make better use of it in their practices. Specifically, it is crucial for instructors to learn the role of individual student characteristics in the feedback process to provide proper guidance and support (Panadero, 2023). For example, instructors can tailor their design and presentation modes of online peer feedback practices to meet the different needs of students with different characteristics (e.g., ability level, feedback literacy), thereby improving the effectiveness of the feedback process and students' performance (Lipnevich et al., 2016; Panadero & Lipnevich, 2022). Additionally, instructors could implement various presentation modes (e.g., guiding questions and feedback evaluation) or combine peer feedback with feedback from other sources (e.g., tutor, AI) to increase students' metacognitive thinking and learning experience (Ho, 2020; Yang & Meng, 2013). In addition to instructors, we advocate for future research efforts to investigate the role of these five key components on online peer feedback practices from the perspective of diverse stakeholders, such as academic managers and faculty deans. This will facilitate a holistic comprehension of the advantages and drawbacks of online peer feedback in higher education.

Overall, by integrating theory, synthesizing the literature, and identifying key components, this study enhances our understanding of online peer feedback and offers valuable guidance for instructors, practitioners, and scholars in the field.

Statement and Declarations

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Data availability

Data will be made available on request.

Appendix A. Characteristics of included publications

Authors & Year	Publication source	N	Region	Duration of research	Discipline	Platform	Methodology	Data collection method
Abri et al. (2021)	Computer-Assisted Language Learning Electronic Journal	50	Oman	10 weeks	English essay writing	Wiki	Mixed-method	Pre- and post-tests Interview
Al Qunayeer et al., 2020	Journal of Information Technology Education: Research	9	N/A	12weeks	EFL writing	Facebook	Qualitative	Content analysis Interview
Cevik (2015)	Computers in Human Behavior	70	Turkey	6weeks	Teacher education	Coursesites	Quantitative	Pre- and Post-test
Chang (2015)	Assessing Writing	22	Taiwan, China	1semester	English	Platform	Mixed-method	Text analysis
Chang and Lin (2020)	Innovations in Education and Teaching International	60	Taiwan, China	12weeks	N/A	A mobile-based ZUVIO Instant Response System and Google Drive	Mixed-method	Questionnaires Pre- and post-test Informal interviews
Chen and Gao (2022)	Computer Assisted Language Learning	31	Mainland China	1semester	English	"e-learning" forum on the university portal	Qualitative	Survey Stimulated recalls Interviews
Chen et al. (2020)	Computers & Education	141	Taiwan, China	13weeks	Musical Theater course	E-musical theater	Mixed-method	Pre- and post-tests Questionnaire
Cheng and Hou (2015)	Technology, Pedagogy and Education	65	Taiwan, China	2weeks	Advanced Communication Technology Workshop	N/A	Mixed-method	Content analysis
Cheng and Tsai (2012)	Australasian Journal of Educational Technology	23	Taiwan, China	18weeks	Communication and technology	Ecampus system	Qualitative	Interview
Cheng et al. (2014)	Interactive Learning Environments	65	Taiwan, China	2weeks	Advanced Communication Technology Workshop	N/A	Mixed-method	Content analysis
Cheng et al. (2015)	Internet and Higher Education	47	Taiwan, China	8weeks	Biology	N/A	Mixed-method	Content analysis

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Authors & Year	Publication source	N	Region	Duration of research	Discipline	Platform	Methodology	Data collection method
Chew et al. (2016)	Innovations in Education and Teaching International	11	UK	1–3weeks	MBA/MSc	Peermark in Turnitin2 system	Qualitative	Interview
Ching (2014)	International Review of Research in Open and Distance Learning	20	US	4weeks	N/A	Voicethread	Qualitative	Content analysis Survey
Choi (2014)	International Journal of Teaching and Learning in Higher Education	27	Hong Kong, China	10 weeks	Early Childhood Education	Wiki	Mixed-method	Content analysis Questionnaire
Day et al. (2022)	Assessment and Evaluation in Higher Education	56	Netherlands	4weeks	Education and child studies	Pitch2Peer module on Blackboard	Mixed-method	Questionnaire Content analysis
De Brún et al. (2022)	Nurse Education Today	264	Ireland	N/A	Nurses and/ Midwives	Peerscholar online platform	Quantitative	Survey Content analysis
Demir (2018)	Higher Education	24	Turkey	6weeks	Science education	Facebook	Qualitative	Semi-structured Interviews
Demirbilek (2015)	Active Learning in Higher Education	51	Turkey	15weeks	Mixed programmes	Wiki & Facebook	Mixed-method	Questionnaire semi-structured interview content analysis
Dippold (2009)	Recall	9	UK	N/A	German language	N/A	Mixed-method	Content analysis Questionnaire Interview
Dominguez et al. (2015)	European Journal of Engineering Education	28/ 91	Portugal	4weeks	Engineering	Google Drive	Mixed-method	Content analysis Questionnaire
Ekahitanond (2013)	Alberta Journal of Educational Research	39	Thailand	12 weeks	Communication arts	Moodle	Mixed-method	Pre- and post-tests Questionnaire
Filius et al. (2018)	Computers & Education	45	Netherlands	N/A	Clinical Epidemiology	Moodle	Mixed-method	Questionnaires Content analysis Interview
Ge (2022)	Computer Assisted Language Learning	60	Mainland, China	19 weeks	English translation	N/A	Qualitative	Pre-and post-test Questionnaire Interview
Gielen and De Wever (2015a)	Computers and Education	125	N/A	N/A	Educational science	Wiki	Quantitative	Questionnaire
Gielen and De Wever (2015b)	Computers in Human Behavior	176	Belgium	9 weeks	Educational science	Wiki	Mixed-method	Content analysis
Ho (2020)	RELC Journal	18	Hong Kong, China	1 semester	English	Gongyeh	Qualitative	Interview
Hoffman (2019)	Journal of Applied Research in Higher Education	387	N/A	2 years	Learning theory and assessment	Expertiza	Quantitative	Quiz
Hsia et al. (2016)	Computers and Education	100	Taiwan, China	12 weeks	Dance education	Myedance	Mixed-method	Interview pre- and post- test
Illana-Mahiques (2021)	Languages	76	US	4 weeks	Spanish writing course	Canvas	Mixed-method	Pre-test Questionnaire Content analysis

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Authors & Year	Publication source	N	Region	Duration of research	Discipline	Platform	Methodology	Data collection method
Jiang et al. (2022)	Interactive Learning Environments	33	Mainland, China	16 weeks	Education technology	Knowledge Forum (KF)	Mixed-method	Questionnaire Content analysis
Kaufman and Schunn (2011)	Instructional Science	250/84	US	1semester	N/A	Sword	Mixed-method	Survey
Kobayashi (2020)	Australasian Journal of Educational Technology	58	US	1semester	Education	Canvas	Mixed-method	Survey Content analysis
Kuo et al. (2017)	International Journal of Distance Education Technologies	42	Taiwan, China	6weeks	Kung Fu Tai-Chi physical education	A peer-assessment- based mobile physical education system	Quantitative	Questionnaire
Lai et al. (2020)	Australasian Journal of Educational Technology	100	Taiwan, China	4weeks	Nursing	Nursing Communication Peer Assessment	Quantitative	Content analysis
Lai (2016)	Computers and Education	50	Taiwan, China	N/A	Nursing	N/A	Mixed-method	Content analysis Survey Interview
Latifi et al, 2021b	British Journal of Educational Technology	86	Iran	5weeks	Applying computer in the educational sciences	Edutech	Quantitative	Pre- and Post-test
Lee (2015)	Turkish Online Journal of Educational Technology	128	Taiwan, China	8weeks	Entrepreneur management	Moodle	Quantitative	Pre- and Post-test
Li and Gao (2016)	Assessment & Evaluation in Higher Education	130	US	16weeks	Teacher education	Blackboard	Mixed-method	Pre- and Post-test
Li et al. (2008)	Canadian Journal of Learning and Technology	38	US	N/A	Teacher education	N/A	Mixed-method	Questionnaire
Liang and Tsai (2010)	Internet and Higher Education	47	Taiwan, China	8weeks	Biology	N/A	Mixed-method	Content analysis
Lin (2016)	Eurasia Journal of Mathematics, Science and Technology Education	31	Taiwan, China	N/A	Teacher education	N/A	Mixed-method	Survey
Lin (2018)	Computers and Education	32	Taiwan, China	N/A	Teacher education	Online Peer Assessment and Reflection (onpear) system	Mixed-method	Content analysis Survey
Lin et al. (2021)	Interactive Learning Environments	115	Taiwan, China	N/A	Electronic commerce	Online discussion forum	Mixed-method	Content analysis Questionnaire
Liu et al. (2018)	Assessment & Evaluation in Higher Education	70	Mainland, China	N/A	Business writing	Web PALS	Mixed-method	Survey
Mandala et al. (2018)	International Journal of Engineering Education	117	US	N/A	Introduction to Mechanical Design	Sword	Mixed-method	Survey Observation Content analysis
Mostert and Snowball (2013)	Assessment and Evaluation in Higher Education	400	South Africa	1semester	Economics	Moodle	Mixed-method	Survey Questionnaire

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Authors & Year	Publication source	N	Region	Duration of research	Discipline	Platform	Methodology	Data collection method
Naveh and Bykhovsky (2021)	IEEE Transactions on Education	105	N/A	1semester	Electrical engineering	Moodle	Mixed-method	Questionnaire
Noroozi and Hatami (2019)	Innovations in Education and Teaching International	42	Netherlands	4days	GMOs	N/A	Mixed-method	Pre- and Post-test questionnaire
Noroozi et al. (2016)	Internet and Higher Education	189	Netherlands	4 h	Biotechnology/ argumentative essay writing	A web-enabled platform	Mixed-method	Pre- and Post-test Questionnaire
Noroozi et al. (2020)	Interactive Learning Environments	189	Netherlands	4 h	Life science	N/A	Mixed-method	Pre- and Post-test Questionnaire
Noroozi et al. (2022)	Interactive Learning Environments	101	Netherlands	3weeks	Argumentative essay writing	Brightspace platform	Mixed-method	Pre- and Post-test Questionnaire Survey
Pham et al. (2020)	SAGE Open	40	Vietnam	15weeks	English language	Google Doc	Mixed-method	Questionnaire content analysis
Prins et al. (2005)	Assessment and Evaluation in Higher Education	27	Netherlands	N/A	European Virtual Seminar (EVS)	Blackboard 5®	Qualitative	Questionnaire
Saeed et al. (2018)	Journal of Information Technology Education: Research	9	N/A	8weeks	Writing	Facebook	Qualitative	Content analysis
Shih (2011)	Australasian Journal of Educational Technology	23	Taiwan, China	18weeks	English writing	Facebook	Mixed-method	Pre-post test Survey Interview Content analysis
Shih (2013)	Turkish Online Journal of Educational Technology	111	Taiwan, China	18weeks	English for Business Communication	Facebook	Mixed-method	Pre-post test Content analysis Survey Interview
Simonsmeier et al. (2020)	Research in Higher Education	49	Germany	4weeks	Educational psychology	Peer review online; PEREON	Mixed-method	Pre- and Post-test
Sun and Zhang (2022)	RELC Journal	79	Mainland, China	16weeks	EFL writing	Shimo online collaborative documents	Mixed-method	Interview Content analysis
Sun et al. (2015)	Plos ONE	299/ 320	N/A	10 weeks	Introductory statistics	N/A	Mixed-method	Quiz
Tsai and Liang (2009)	Instructional Science: An International Journal of the Learning Sciences	36	Taiwan, China	8weeks	Early childhood and pre-school education	N/A	Mixed-method	Questionnaire Content analysis
Tsivitanidou and Constantinou (2016)	Internet and Higher Education	27	Cyprus	N/A	Marine ecosystems	Dropbox platform	Mixed-method	Pre- and post-tests Interview
van den Bos and Tan (2019)	Computers and Education	114	Netherlands	8weeks	English writing	Peergrade	Mixed-method	Content analysis
van der Pol et al. (2008)	Computers & Education	38	Netherlands	3months	Educational science	Blackboard & Annotation system	Mixed-method	Content analysis
Wang et al. (2020)	Assessment & Evaluation in Higher Education	31	US	N/A	Education	Blackboard	Mixed-method	Questionnaires Interview
Wilkinson (2022)	Online Learning Journal	14	US	7weeks	Communication	Brightspace Desire to Learn	Mixed-method	Questionnaires Interview Observation

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Authors & Year	Publication source	N	Region	Duration of research	Discipline	Platform	Methodology	Data collection method
Xiao and Lucking (2008)	Internet and Higher Education	232	US	1semester	Introduction to the social and cultural foundations of American education	Wikibook	Mixed-method	Questionnaire
Yang (2011)	British Journal of Educational Technology	95	Taiwan, China	9months	English writing	N/A	Mixed-method	Content analysis
Yang and Meng (2013)	Language Learning & Technology	50	Taiwan, China	12weeks	English writing	Computer-supported collaborative learning system (CSCL)	Mixed-method	Questionnaire content analysis
Yu et al. (2019)	Assessment & Evaluation in Higher Education	3	Macau, China	N/A	Education	N/A	Qualitative	Interview Stimulated recalls
Yuan and Kim (2018)	Educational Technology Research and Development	73	US	14weeks	Education	Autonomy-Supportive Peer Assessment (ASPA),	Mixed-method	Survey Interview
Zhan (2021)	Assessment & Evaluation in Higher Education	93	Hong Kong, China	1semester	General education foundation course	Peergrade	Mixed-method	Interview
Zheng et al. (2018)	Assessment & Evaluation in Higher Education	64	Mainland, China	N/A	Mixed programmes	Web-based peer assessment system	Mixed-method	Questionnaires Interview
Zong et al. (2021)	Computers in Human Behavior	2421	US	N/A	Mixed programmes	Sword/Peerceptiv	Mixed-method	Content analysis Post test

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